What is claimed is:

1. A low eddy current cryogen circuit for superconducting magnets comprising:

at least a first cooling coil comprising an electrically conducting material; and

at least one electrical isolator incorporated in the first cooling coil, the electrical isolator located to inhibit induced eddy current loops in the cryogen circuit due to inductive coupling of the first cooling coil with eddy current inducing field sources.

2. The cryogen circuit of claim 1, wherein the electrical isolator comprises a ceramic tube.

3. The cryogen circuit of claim 1, wherein the eddy current inducing field sources include magnetic field sources or AC field sources.

4. The cryogen circuit of claim 1, wherein the first cooling coil has a plurality of bends forming a serpentine shape.

5. The cryogen circuit of claim 4, wherein the bends in the first cooling coil are angled such that a gas bubble in a liquid in the first cooling tube would flow upwards under the force of gravity.

6. The cryogen circuit of claim 4, further comprising filler pieces between the bends in the first cooling coil.

7. The cryogen circuit of claim 6, further comprising a flexible backing, wherein the first cooling coil and the filler pieces are affixed to the flexible backing.

8. The cryogen circuit of claim 1, wherein the first cooling coil has a diameter less than about 7 mm.

9. The cryogen circuit of claim 8, wherein the first cooling coil has a diameter greater than about 3 mm and less than about 7 mm.

10. The cryogen circuit of claim 1, further comprising a second cooling coil having at least a second electrical isolator incorporated in the second cooling coil, the second electrical isolator located to inhibit induced magnetic fields due to inductive coupling of the second cooling coil with eddy current inducing field sources, wherein the both the first and second cooling coils have a substantially semicircular portion and the first and second cooling coils are located relative to each other to form a cooling band having a substantially circular shape.

11. The cryogen circuit of claim 10, further comprising a plurality of cooling bands and a manifold, wherein the manifold is adapted to distribute cryogen among the plurality of cooling bands.

12. The cryogen circuit of claim 11, further comprising a liquid cryogen reservoir fluidly connected to the first and second cooling coils.

13. The cryogen circuit of claim 12, wherein the liquid cryogen reservoir is located above the first and second cooling coils and is fluidly connected to a bottom portion of the first and second cooling coils.

14. The cryogen circuit of claim 13, further comprising a heater located inside the cryogen reservoir.

15. The cryogen circuit of claim 14, further comprising at least one thermal shield.

16. The cryogen circuit of claim 15, further comprising at least one thermal shield cooling coil circumscribing the thermal shield, the at least one thermal shield cooling coil having at least one electrical isolator incorporated in the at least one thermal shield cooling coil and located to inhibit induced magnetic fields due to inductive coupling of the at least one thermal shield cooling coil with eddy current inducing field sources.

17. The cryogen circuit of claim 16, further comprising a cryocooler and a condenser thermally connected to the cryocooler, wherein top portions of the first and second cooling coils are fluidly connected to the condenser.

18. The cryogen circuit of claim 17, wherein the cryocooler comprises two stages, the condenser is thermally connected to the second stage of the crycooler and the thermal shield cooling coil is thermally connected to the first stage of the crycooler.

19. The cryogen circuit of claim 18, wherein the cryogen reservoir, the cooling band and the condenser comprise a coil cooling subcircuit; the thermal shield cooling coil and the first stage of the cryocooler comprise a thermal shield subcircuit, and wherein the cryogen circuit further comprises:

a first pressure relief valve connecting coil cooling subcircuit and the thermal shield subcircuit;

a second pressure relief valve venting the thermal shield subcircuit to atmosphere; and

a one-way valve between the first stage of the cryocooler and an infeed portion of the thermal shield cooling coil.

20. An MRI system comprising a superconducting magnet and the cryogen circuit of claim 1, wherein the cryogen circuit is adapted to cool the superconducting magnet.

21. A method of cooling a superconducting magnet comprising:

providing a superconducting magnet in thermal contact with at least a first cooling coil incorporating at least one electrical isolator, the electrical isolator located to inhibit induced eddy current loops due to inductive coupling of the first cooling coil with eddy current inducing field sources; and

passing a cryogen through the first cooling coil.

22. The method of claim 21, further comprising providing a second cooling coil in thermal contact with the superconducting magnet, the second cooling coil incorporating at least a second electrical isolator, the second electrical isolator located to inhibit induced magnetic fields due to inductive coupling of the second cooling coil with eddy current inducing field sources, wherein the both the first and second cooling coils have a substantially semicircular portion and the first and second cooling coils are located relative to each other to form a cooling band having a substantially circular shape.

23. The method of claim 22, wherein passing the cryogen comprises feeding the first and second cooling coils with cryogen from cryogen reservoir located above the cooling band.

24. The method of claim 23, wherein the first and second coils have top and bottom portions and the cryogen is fed into the bottom portions and exits from the top portions.

25. The method of claim 24, wherein the cryogen fed into the bottom portions of the first and second cooling coils is liquid and at least a portion of the cryogen exiting the top portions of the first and second cooling coils is gaseous.

26. The method of claim 25, further comprising directing the gaseous portion of the cryogen to a condenser.

27. The method of claim 26, wherein the condenser is attached to a second stage of a two stage cryocooler.

28. The method of claim 27, further comprising providing a thermal shield circumscribed with at least one thermal shield cooling coil, the at least one thermal shield cooling coil having at least one electrical isolator incorporated in the at least one thermal shield cooling coil and located to inhibit induced magnetic fields due to inductive coupling of the at least one thermal shield cooling coil with eddy current inducing field sources.

29. The method of claim 28, further comprising feeding cryogen into an infeed portion of the thermal shield cooling coil at a first temperature and removing the cryogen from an exit portion of the thermal shield cooling coil at a second temperature, wherein the second temperature is higher than the first temperature.

30. The method of claim 29, further comprising turning on a heater located in the cryogen reservoir if a pressure in the reservoir drops below a predetermined pressure.

31. The method of claim 30, wherein the predetermined pressure balances a cooling capacity of the second stage of the cryocooler with a heat load of the from the cooling band.

32. The method of claim 31, wherein the cryogen reservoir, the cooling band and the condenser comprise a coil cooling subcircuit; the thermal shield cooling coil and the first stage of the cryocooler comprise a thermal shield subcircuit, the cooling subcircuit and the thermal shield subcircuit comprise a low eddy current cryogen circuit and wherein the a low eddy current circuit further comprises:

a first pressure relief valve connecting coil cooling circuit and the thermal shield circuit;

a second pressure relief valve venting the thermal shield circuit to atmosphere; and

a one-way valve between the first stage of the cryocooler and the infeed portion of the thermal shield cooling coil.

33. The method of claim 32, further comprising opening the first pressure relief valve and allowing cryogen from the coil cooling subcircuit to flow into the thermal shield subcircuit, if a pressure difference between the coil cooling subcircuit and the thermal shield subcircuit exceeds a first relief pressure.

34. The method of claim 33, wherein the pressure in the low eddy current circuit is always above atmospheric pressure during operation.

35. The method of claim 34, wherein if the cryocooler fails, cryogen in the cryogen reservoir provides latent cooling for ride-through for at least 4 hours.

36. The method of claim 35, wherein cryogen in the cryogen reservoir provides latent cooling for ride-through for at least 12 hours.

37. An MRI system comprising:

a superconducting magnet; and

a low eddy current cryogen circuit, the low eddy current cryogen circuit having at least a first cooling coil in thermal contact with the superconducting magnet.

38. The MRI system of claim 37, wherein the first cooling coil comprises an electrically conducting material and at least one electrical isolator incorporated in the first cooling coil, the electrical isolator located to inhibit induced magnetic fields due inductive coupling of the first cooling coil with eddy current inducing field sources.

39. The MRI system of claim 38, wherein the superconducting magnet comprises a coil of superconducting material and the first cooling coil is located on an outer surface of the coil of superconducting material.

40. The MRI system of claim 39, wherein the first cooling coil has a plurality of bends in a serpentine shape and wherein the bends in the first cooling coil are angled such that a gas bubble in a liquid in the first cooling tube would flow upwards under the force of gravity.

41. The MRI system of claim 40, wherein the low eddy current cryogen circuit further comprises a second cooling coil having at least a second electrical isolator incorporated in the second cooling coil, the second electrical isolator located to inhibit induced magnetic fields due to inductive coupling of the second cooling coil with eddy current inducing field sources, wherein the both the first and second cooling coils have a substantially semicircular portion and the first and second cooling coils are located relative to each other to form a cooling band having a substantially circular shape.

42. The MRI system of claim 41, wherein the low eddy current cryogen circuit further comprises a plurality of cooling bands and at least some of the plurality of cooling bands are incorporated within windings of the superconducting coil.

43. The MRI system of claim 42, further comprising a liquid cryogen reservoir fluidly connected to the first and second cooling coils.

44. The MRI system of claim 43, further comprising at least one thermal shield cooling coil circumscribing the thermal shield, the at least one thermal shield cooling coil having at least one electrical isolator incorporated in the at least one thermal shield cooling coil and located to inhibit induced magnetic fields due to inductive coupling of the at least one thermal shield cooling coil with eddy current inducing field sources.

45. The MRI system of claim 44, further comprising a cryocooler and a condenser thermally connected to the cryocooler, wherein top portions of the first and second cooling coils are fluidly connected to the condenser and wherein the cryocooler comprises two stages, the condenser is thermally connected to the second stage of the crycooler and the thermal shield cooling coil is thermally connected to the first stage of the crycooler.

46. The MRI system of claim 45, further comprising at least one gradient coil and an RF shield.

47. A method of making a cooling band comprising:

providing a first cooling coil and a second cooling coil, the first and second cooling coils having a substantially semicircular portion; and

affixing the first and second cooling coils to a flexible backing such that the first and second cooling coils form a substantially circular shape.

48. The method of claim 47, wherein the first and second cooling coils have a plurality of bends forming a serpentine shape.

49. The method of claim 48, wherein the bends in the first cooling coil are angled sūch that a gas bubble in a liquid in the first cooling tube would flow upwards under the force of gravity.

50. The method of claim 48, further comprising affixing filler pieces between the bends in the first and second cooling coils.

51. The method of claim 50, wherein the filler pieces comprise a polymer.

52. The method of claim 51, wherein the polymer comprises a phenolic polymer.

53. The method of claim 47, wherein the cooling coils comprise stainless steel or copper.

54. The method of claim 53, further comprising incorporating an electric isolator in the first and second cooling coils.

55. The method of claim 54, wherein the first cooling coil has first and second portions and the second cooling coil has third and fourth portions and the step of incorporating comprises inserting tubes comprising an electrically insulating material in between the first and second portions of the first cooling coil and in between the third and fourth portions of the second cooling coil.

56. The method of claim 54, wherein the electric isolator comprises ceramic.